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Shiiyama

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(54) **REPRODUCTION CONTROL OF REPRODUCTION APPARATUS BASE ON REMAINING POWER OF BATTERY**

(75) Inventor: **Hirotaka Shiiyama**, Kanagawa (JP)

(73) Assignee: **Canon Kabushiki Kaisha**, Tokyo (JP)

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This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.** **386/200**

(58) **Field of Classification Search** 348/333.01, 348/362, 372; 386/277, 200, 217; 713/300, 713/320; 358/406; 455/573
See application file for complete search history.

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Primary Examiner — Thai Tran
Assistant Examiner — Stephen Smith
(74) *Attorney, Agent, or Firm* — Cowan, Liebowitz & Latman, P.C.

(57) **ABSTRACT**

A reproduction apparatus includes a reproduction unit that reproduces digital data selected by a user; a prediction unit that predicts a reproducible time based on remaining power of a battery and a determination unit that determines whether the digital data selected by the user can be reproduced to the end or not based on the reproducible time, wherein when the determination unit determines that the selected digital data can be reproduced to the end, the reproduction apparatus causes the reproduction unit to reproduce the selected digital data and when the determination unit determines that the selected digital data cannot be reproduced to the end, the reproduction apparatus warns that the digital data cannot be reproduced to the end.

20 Claims, 6 Drawing Sheets

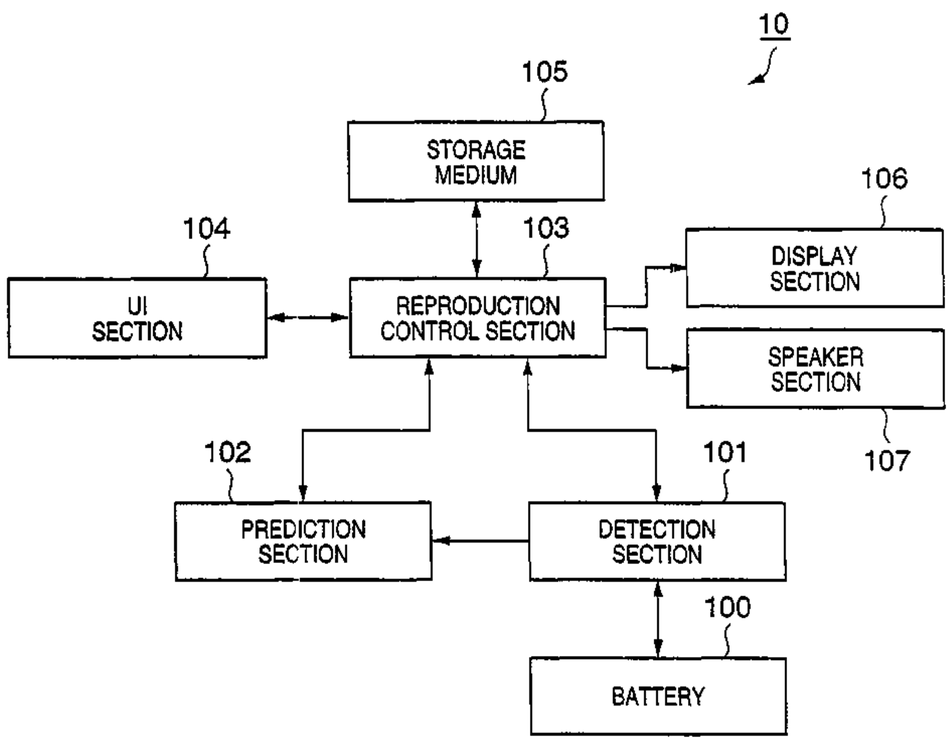

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FIG. 1

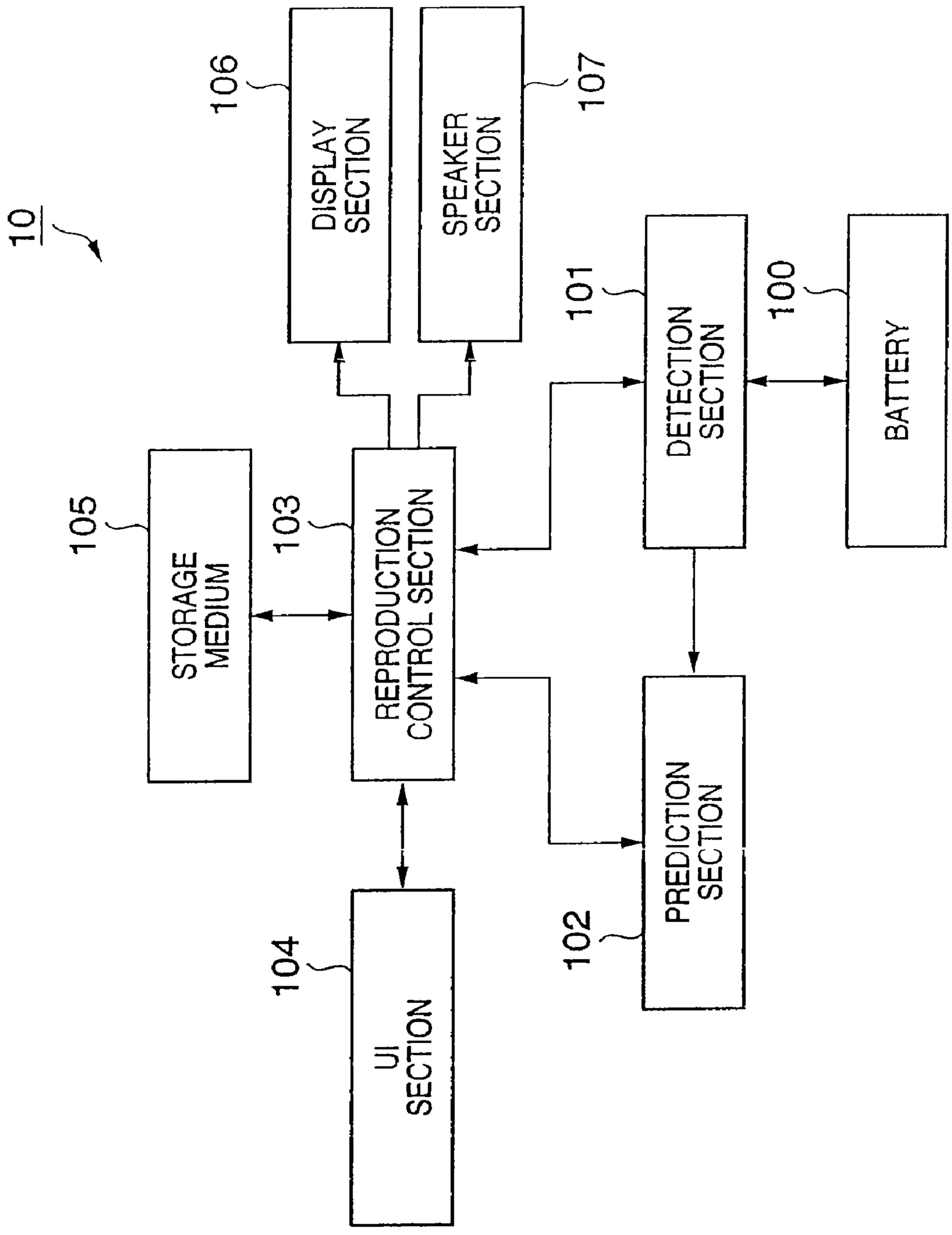

10
106
DISPLAY SECTION
107
SPEAKER SECTION
101
DETECTION SECTION
100
BATTERY
105
STORAGE MEDIUM
103
REPRODUCTION CONTROL SECTION
102
PREDICTION SECTION
104
UI SECTION

FIG. 2

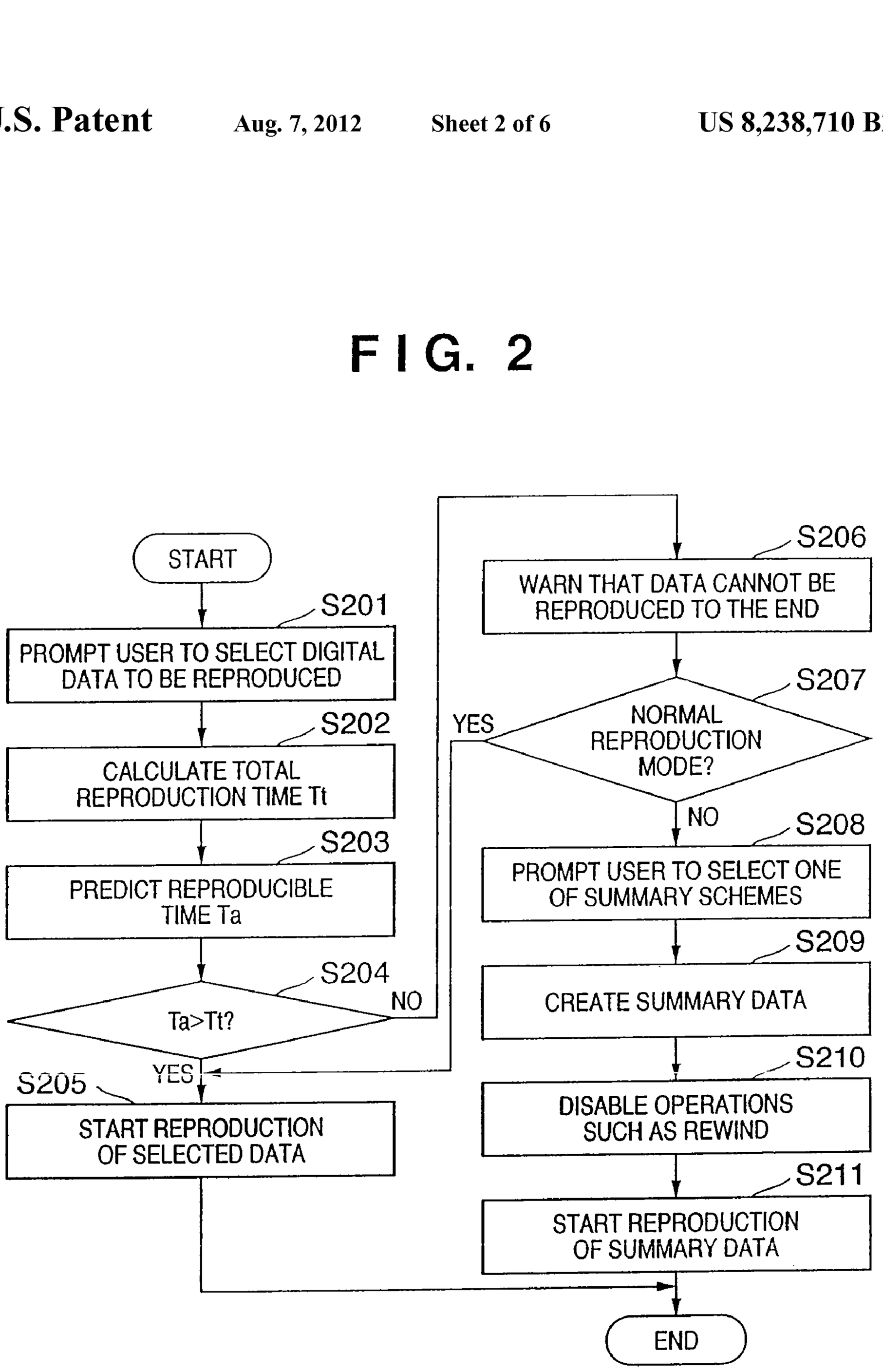

START
S201
PROMPT USER TO SELECT DIGITAL DATA TO BE REPRODUCED
S202
CALCULATE TOTAL REPRODUCTION TIME Tt
S203
PREDICT REPRODUCIBLE TIME Ta
S204
Ta>Tt?
NO
YES
S205
START REPRODUCTION OF SELECTED DATA
S206
WARN THAT DATA CANNOT BE REPRODUCED TO THE END
S207
NORMAL REPRODUCTION MODE?
YES
NO
S208
PROMPT USER TO SELECT ONE OF SUMMARY SCHEMES
S209
CREATE SUMMARY DATA
S210
DISABLE OPERATIONS SUCH AS REWIND
S211
START REPRODUCTION OF SUMMARY DATA
END

FIG. 3

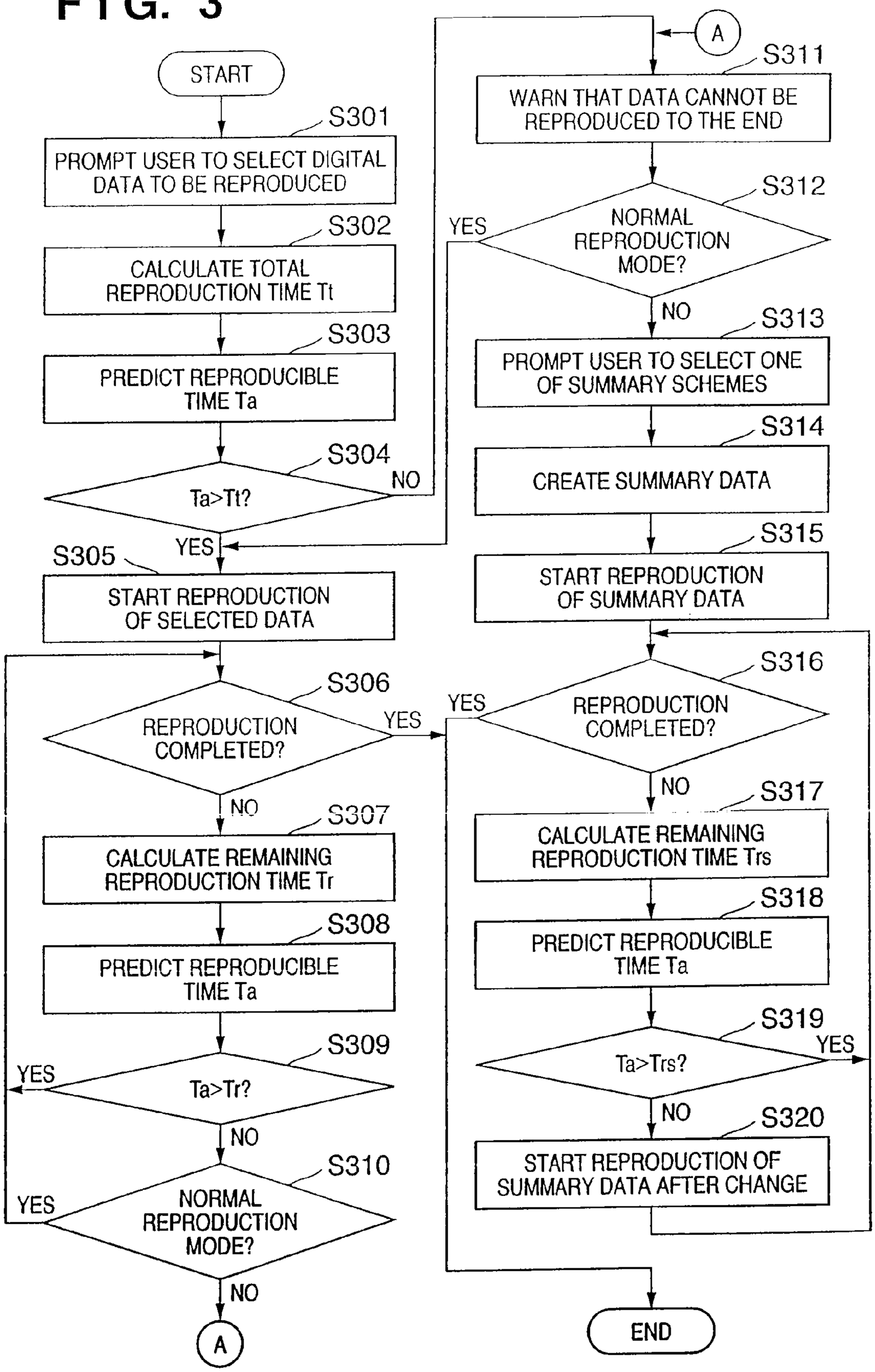

START
S301
PROMPT USER TO SELECT DIGITAL DATA TO BE REPRODUCED
S302
CALCULATE TOTAL REPRODUCTION TIME Tt
S303
PREDICT REPRODUCIBLE TIME Ta
S304
Ta>Tt?
NO
YES
S305
START REPRODUCTION OF SELECTED DATA
S306
REPRODUCTION COMPLETED?
YES
NO
S307
CALCULATE REMAINING REPRODUCTION TIME Tr
S308
PREDICT REPRODUCIBLE TIME Ta
S309
Ta>Tr?
YES
NO
S310
NORMAL REPRODUCTION MODE?
YES
NO
A
A
S311
WARN THAT DATA CANNOT BE REPRODUCED TO THE END
S312
NORMAL REPRODUCTION MODE?
YES
NO
S313
PROMPT USER TO SELECT ONE OF SUMMARY SCHEMES
S314
CREATE SUMMARY DATA
S315
START REPRODUCTION OF SUMMARY DATA
S316
REPRODUCTION COMPLETED?
YES
NO
S317
CALCULATE REMAINING REPRODUCTION TIME Trs
S318
PREDICT REPRODUCIBLE TIME Ta
S319
Ta>Trs?
YES
NO
S320
START REPRODUCTION OF SUMMARY DATA AFTER CHANGE
END

FIG. 4

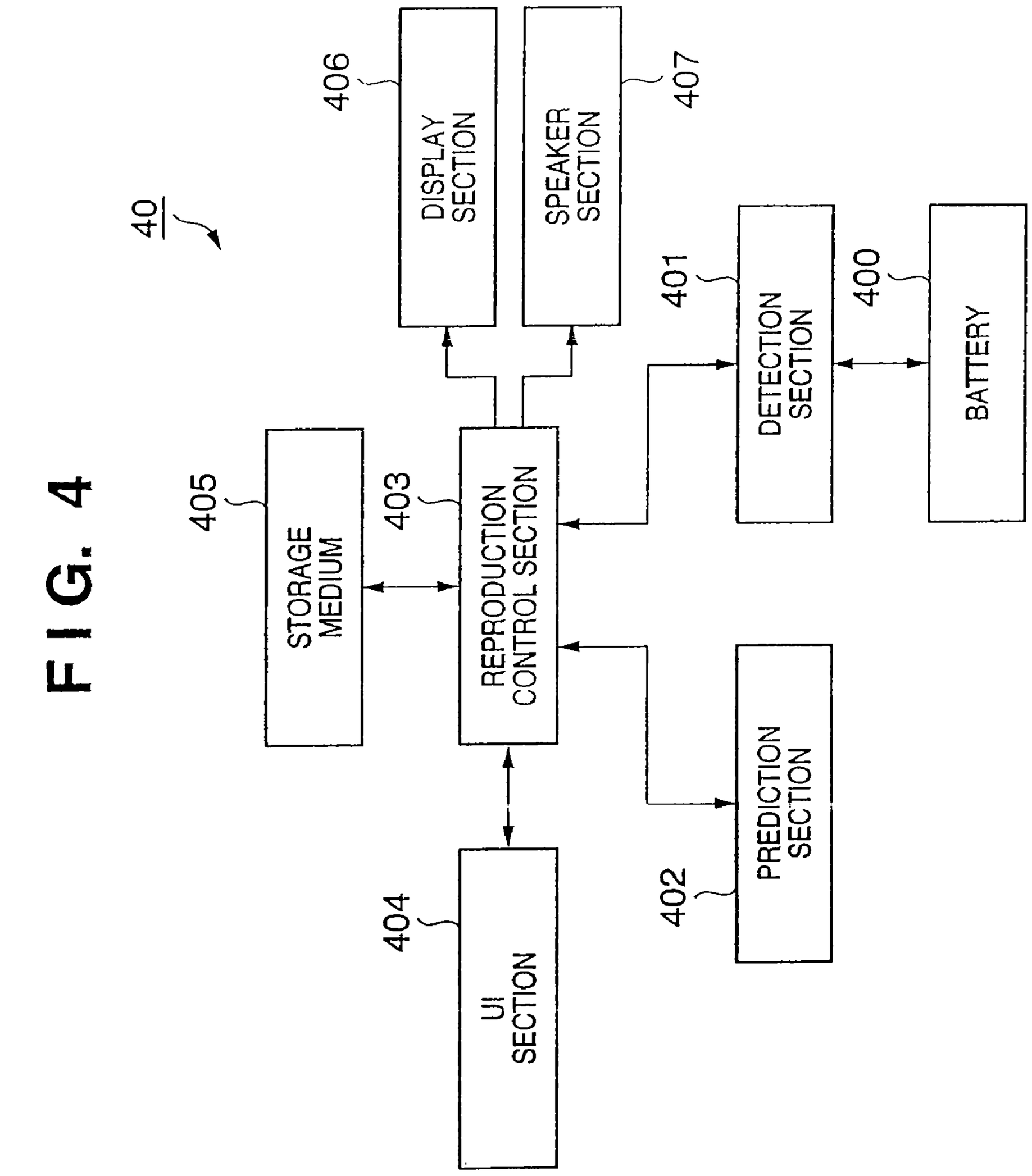

40
405
STORAGE MEDIUM
403
REPRODUCTION CONTROL SECTION
406
DISPLAY SECTION
407
SPEAKER SECTION
401
DETECTION SECTION
400
BATTERY
404
UI SECTION
402
PREDICTION SECTION

FIG. 5

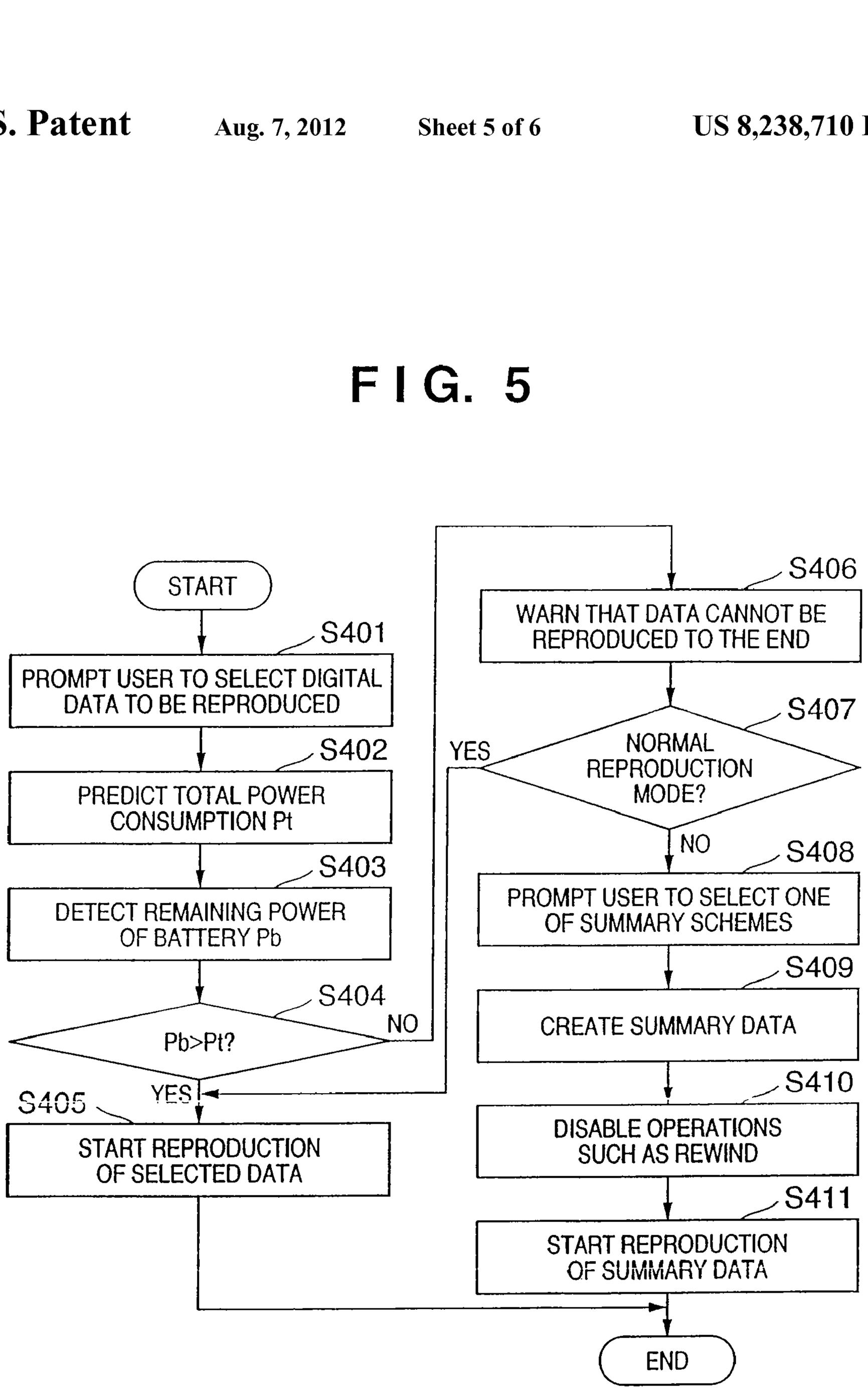
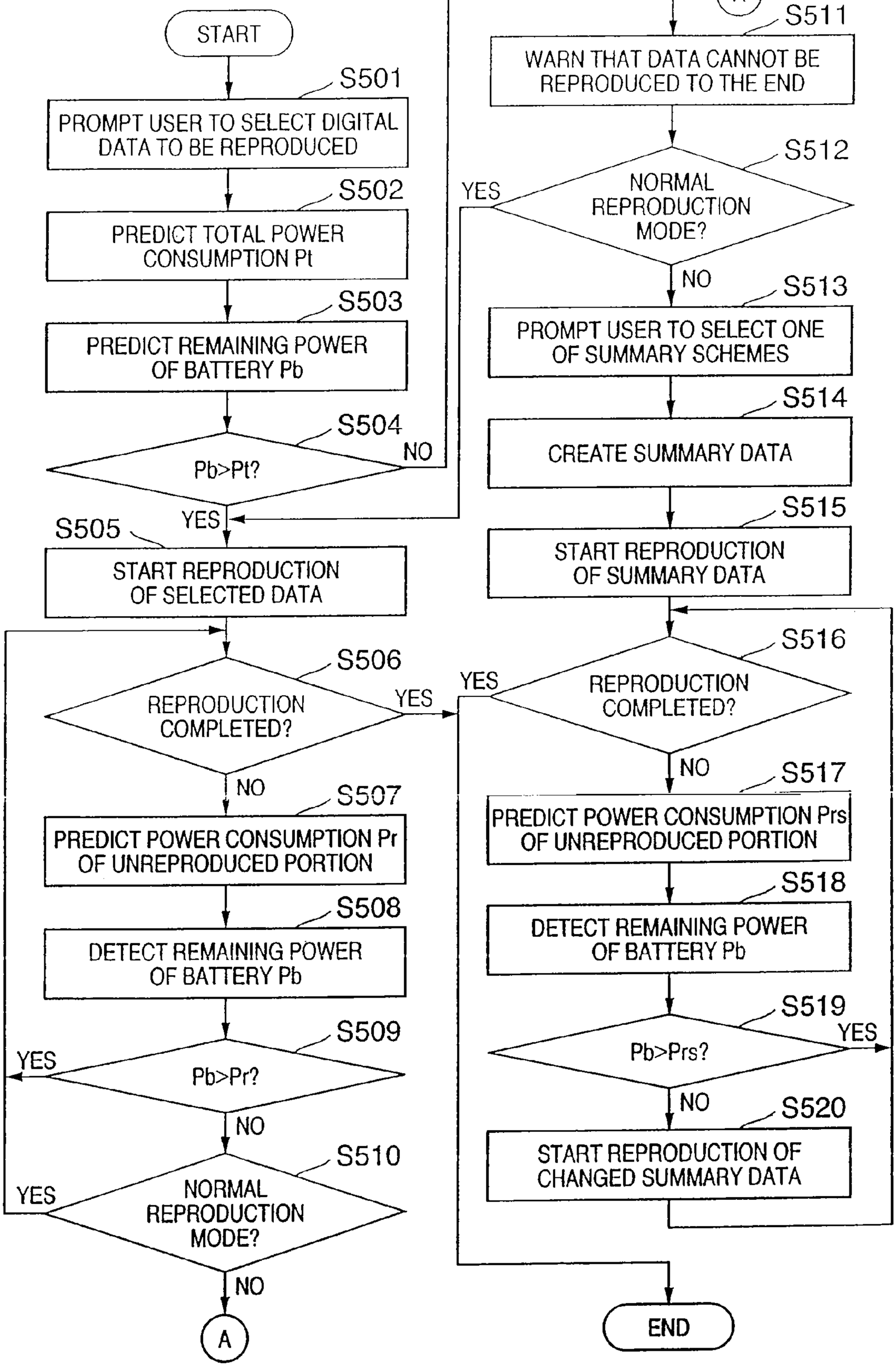

START
S401
PROMPT USER TO SELECT DIGITAL DATA TO BE REPRODUCED
S402
PREDICT TOTAL POWER CONSUMPTION Pt
S403
DETECT REMAINING POWER OF BATTERY Pb
S404
Pb>Pt?
NO
YES
S405
START REPRODUCTION OF SELECTED DATA
S406
WARN THAT DATA CANNOT BE REPRODUCED TO THE END
S407
NORMAL REPRODUCTION MODE?
YES
NO
S408
PROMPT USER TO SELECT ONE OF SUMMARY SCHEMES
S409
CREATE SUMMARY DATA
S410
DISABLE OPERATIONS SUCH AS REWIND
S411
START REPRODUCTION OF SUMMARY DATA
END

FIG. 6


START
S501
PROMPT USER TO SELECT DIGITAL DATA TO BE REPRODUCED
S502
PREDICT TOTAL POWER CONSUMPTION Pt
S503
PREDICT REMAINING POWER OF BATTERY Pb
S504
Pb>Pt?
NO
YES
S505
START REPRODUCTION OF SELECTED DATA
S506
REPRODUCTION COMPLETED?
YES
NO
S507
PREDICT POWER CONSUMPTION Pr OF UNREPRODUCED PORTION
S508
DETECT REMAINING POWER OF BATTERY Pb
S509
Pb>Pr?
YES
NO
S510
NORMAL REPRODUCTION MODE?
YES
NO
A
A
S511
WARN THAT DATA CANNOT BE REPRODUCED TO THE END
S512
NORMAL REPRODUCTION MODE?
YES
NO
S513
PROMPT USER TO SELECT ONE OF SUMMARY SCHEMES
S514
CREATE SUMMARY DATA
S515
START REPRODUCTION OF SUMMARY DATA
S516
REPRODUCTION COMPLETED?
YES
NO
S517
PREDICT POWER CONSUMPTION Prs OF UNREPRODUCED PORTION
S518
DETECT REMAINING POWER OF BATTERY Pb
S519
Pb>Prs?
YES
NO
S520
START REPRODUCTION OF CHANGED SUMMARY DATA
END

REPRODUCTION CONTROL OF REPRODUCTION APPARATUS BASE ON REMAINING POWER OF BATTERY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional of application Ser. No. 10/454,206, filed Jun. 4, 2003 now U.S. Pat. No. 7,246,249, the entire disclosure of which is hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to an apparatus for reproducing digital data such as video data and audio data, and more particularly, to a reproduction apparatus that carries out reproduction processing in consideration of remaining power of a battery.

BACKGROUND OF THE INVENTION

Portable devices such as a portable video player, portable audio player, notebook PC and PDA (Personal Digital Assistant) are driven by a battery and have the function of reproducing digital data such as video data and audio data.

However, conventional portable devices cannot carry out reproduction processing in consideration of remaining power of a battery. Thus, the conventional portable devices cannot decide before reproducing desired digital data whether the digital data can be reproduced to the end or not.

SUMMARY OF THE INVENTION

The present invention has been made in consideration of the above situation, and has as its object to implement reproduction processing in consideration of the remaining power of the battery.

According to the present invention, the foregoing object is attained by providing a reproduction apparatus comprising: a reproduction unit that reproduces digital data selected by a user; a prediction unit that predicts a reproducible time based on remaining power of a battery; and a determination unit that determines whether digital data selected by a user can be reproduced to the end or not based on the reproducible time predicted by the prediction unit before the reproduction unit starts reproducing the selected data, wherein if it is determined by the determination unit that the selected digital data can be reproduced to the end, the reproduction apparatus causes the reproduction unit to reproduce the selected digital data, and if it is determined by the determination unit that the selected digital data cannot be reproduced to the end, the reproduction apparatus warns that the digital data cannot be reproduced to the end.

According to the present invention, the foregoing object is also attained by providing a control method for controlling a reproduction apparatus, comprising: predicting a reproducible time based on remaining power of a battery; determining whether digital data selected by a user can be reproduced to the end or not based on the reproducible time predicted in the predicting step, before reproduction unit of the reproduction apparatus starts reproducing the selected digital data; causing the reproduction unit to reproduce the selected digital data if it is determined in the determining step that the selected digital data can be reproduced to the end, and warning when it is determined that the selected digital data cannot be reproduced to the end that the digital data cannot be reproduced to the end.

Further, the foregoing object is also attained by providing a reproduction apparatus comprising: a detection unit that detects remaining power of a battery; and a determination unit that determines whether digital data selected by a user can be reproduced to the end or not based on the remaining power of the battery, wherein when the digital data cannot be reproduced to the end, an alarm is issued to indicate that the digital data cannot be reproduced to the end.

Furthermore, the foregoing object is also attained by providing a control method comprising: detecting remaining power of a battery; determining whether digital data selected by a user can be reproduced to the end or not based on the remaining power of the battery; warning when the digital data cannot be reproduced to the end that the digital data cannot be reproduced to the end.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. **1** is a block diagram showing a configuration example of a reproduction apparatus according to first and second embodiments;

FIG. **2** is a flow chart showing a processing procedure of the reproduction apparatus according to the first embodiment;

FIG. **3** is a flow chart showing a processing procedure of the reproduction apparatus according to the second embodiment;

FIG. **4** is a block diagram showing a configuration example of a reproduction apparatus according to third and fourth embodiments;

FIG. **5** is a flow chart showing a processing procedure of the reproduction apparatus according to the third embodiment of the present invention; and

FIG. **6** is a flow chart showing a processing procedure of the reproduction apparatus according to the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described in detail in accordance with the accompanying drawings.

First Embodiment

With reference to FIG. **1** and FIG. **2**, a first embodiment of the present invention will be explained in detail below.

First, with reference to the block diagram in FIG. **1**, a configuration example of a reproduction apparatus **10** according to a first embodiment will be explained. The reproduction apparatus **10** shown in FIG. **1** is a portable device that is driven by a battery **100** and has the function of reproducing digital data stored in a storage medium **105**. The digital data that the reproduction apparatus **10** reproduces from the storage medium **105** may be video data, audio data, or video data with audio data.

As shown in FIG. **1**, the reproduction apparatus **10** includes the battery **100**, a detection section **101**, a prediction section **102**, a reproduction control section **103**, a UI section **104**, a storage medium **105**, a display section **106** and a speaker section **107**.

The detection section **101** has the function of detecting the remaining power of the battery **100**. The prediction section **102** has the function of predicting an reproducible time using the remaining power of the battery **100**. The reproduction control section **103** has the function of reproducing the digital data selected by the user from the storage medium **105**. The user interface section (UI section) **104** has the function of notifying the reproduction control section **103** of the user's instructions. The display section **106** displays video data in the digital data reproduced from the storage medium **105**. The speaker section **107** outputs the audio data in the digital data reproduced from the storage medium **105**.

Next, the processing procedure of the reproduction apparatus **10** according to the first embodiment will be explained with reference to the flow chart in FIG. **2**.

In step S**201**, the UI section **104** prompts the user to select digital data to be reproduced.

In step S**202**, the reproduction control section **103** calculates a total reproduction time Tt which is a time required to reproduce all the digital data selected by the user (hereinafter referred to as "selected data").

In step S**203**, the reproduction control section **103** makes the detection section **101** detect the current remaining power of the battery **100** and makes the prediction section **102** predict the current reproducible time Ta. At this time, the detection section **101** detects the current remaining power of the battery **100** and notifies it to the prediction section **102**. In turn, the prediction section **102** predicts the current reproducible time Ta using the current remaining power of the battery **100** and notifies it to the reproduction control section **103**.

In step S**204**, the reproduction control section **103** decides whether the current reproducible time Ta is longer than the total reproduction time Tt or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not.

When the current reproducible time Ta is longer than the total reproduction time Tt (YES in step S**204**), the selected data can be reproduced to the end. In this case, the process moves on to step S**205** and the reproduction control section **103** starts reproduction of the selected data without creating any summary of the selected data.

On the other hand, if the current reproducible time Ta is not longer than the total reproduction time Tt (NO in step S**204**), the battery **100** will be exhausted during reproduction of the selected data, and therefore the selected data will not be reproduced to the end. In this case, the process moves on to step S**206** and the reproduction control section **103** displays a message or icon on the display section **106** indicating that the selected data cannot be reproduced to the end and warns the user of it. At this time, the reproduction control section **103** can also display the total reproduction time Tt, reproducible time Ta and their difference on the display section **106**.

In step S**207**, the UI section **104** prompts the user to select a normal reproduction mode or summary reproduction mode. When the user selects the normal reproduction mode, the process in step S**205** is executed. On the other hand, if the user selects the summary reproduction mode, the process in step S**208** is executed.

In step S**208**, the UI section **104** prompts the user to select one of summary schemes.

In step S**209**, the reproduction control section **103** generates summary data which is a summary of the selected data based on the summary scheme selected by the user. At this time, the reproduction control section **103** makes sure that the total reproduction time of the summary data is shorter than a current reproducible time Ta. It should be noted that if the time taken to generate the summary is long, the remaining power of the battery **100** may reduce drastically causing the reproducible time to be shortened. Thus, upon creating summary data the reproduction apparatus **10** according to the first embodiment re-predicts a reproducible time at predetermined intervals and compares it with the total reproduction time.

After the reproduction of the summary data is started, operations such as fast rewind, fast forward and pause may reduce the remaining power of the battery **100** drastically, causing the battery **100** to be exhausted during the reproduction of the summary data. Therefore, the UI section **104** starts the reproduction of the summary and then disables operations other than stop (fast rewind, fast forward, pause, etc.) in step S**210**. This function prevents the reproduction of the summary data from being interrupted midway.

In step S**211**, the reproduction control section **103** starts to reproduce the summary data. If video data is found in the summary data, the reproduction control section **103** processes it and supplies it to the display section **106** and if audio data is found in the summary data, the reproduction control section **103** processes it and supplies it to the speaker section **107**.

As described above, the reproduction apparatus **10** according to the first embodiment can perform reproduction processing in consideration of the remaining power of the battery **100**. Furthermore, when the remaining power of the battery **100** is too small to reproduce the digital data selected by the user to the end, the reproduction apparatus **10** according to the first embodiment can warn the user of it.

Next, the summary scheme that can be selected in step S**208** will be explained.

(1) Summary Scheme 1

In this scheme, the reproduction control section **103** automatically generates summary data of the selected data.

(2) Summary Scheme 2

This scheme allows the user to select portions to be reproduced and gathers the portions selected by the user to generate summary data of the selected data.

(3) Summary System 3

In this scheme, the reproduction control section **103** automatically generates summary data of the selected data based on user preference information which is information on the user's preferences. As the user's preference information, it is possible to use information specified by the MPEG-7 standard.

(4) Summary System 4

This scheme allows the user to select portions to be reproduced from among portions automatically selected by the reproduction control section **103** based on the user's preference information and gathers the portions selected by the user to generate summary data of the selected data.

Second Embodiment

With reference to FIG. **1** and FIG. **3**, a second embodiment of the present invention will be explained in detail below.

With reference to the flow chart in FIG. **3**, a processing procedure of the reproduction apparatus **10** according to the second embodiment will be explained.

In step S**301**, the UT section **104** prompts the user to select digital data to be reproduced.

In step S**302**, the reproduction control section **103** calculates a total reproduction time Tt, which is a time necessary to reproduce all digital data selected by the user (hereinafter referred to as "selected data").

In step S**303**, the reproduction control section **103** makes the detection section **101** detect the current remaining power of the battery **100** and makes the prediction section **102** predict the current reproducible time Ta. At this time, the detection section **101** detects the current remaining power of the battery **100** and notifies it to the prediction section **102**. In turn, the prediction section **102** predicts the current reproducible time Ta using the current remaining power of the battery **100** and notifies it to the reproduction control section **103**.

In step S304, the reproduction control section 103 decides whether the current reproducible time Ta is longer than the total reproduction time Tt or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not.

When the current reproducible time Ta is longer than the total reproduction time Tt (YES in step S304), the selected data can be reproduced to the end. In this case, the process moves on to step S305 and the reproduction control section 103 starts reproduction of the selected data without creating any summary of the selected data.

In step S306, the reproduction control section 103 decides whether the reproduction of the selected data is completed or not.

If the reproduction of the selected data is not completed (No in step S306), in step S307, the reproduction control section 103 calculates the remaining reproduction time Tr of the selected data.

In step S308, the reproduction control section 103 makes the detection section 101 redetect the current remaining power of the battery 100 and makes the prediction section 102 predict the current reproducible time Ta. At this time, the detection section 101 detects the current remaining power of the battery 100 and notifies it to the prediction section 102. In turn, the prediction section 102 predicts the current reproducible time Ta using the current remaining power of the battery 100 and notifies it to the reproduction control section 103.

In step S309, the reproduction control section 103 decides whether the current reproducible time Ta is longer than the remaining reproduction time Tr or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not. If the reproducible time Ta is longer than the remaining reproduction time Tr (YES in step S309), the process moves back to step S306 and the reproduction control section 103 continues to reproduce the selected data.

When the current reproducible time Ta is not longer than the reproduction time Tr (NO in step S309), the selected data cannot be reproduced to the end. In this case, the process moves on to step S310 and the reproduction control section 103 decides whether a normal reproduction mode is selected or not. If the normal reproduction mode is selected, the reproduction control section 103 continues to reproduce the selected data without generating any summary.

After the determination of step S304, when the current reproducible time Ta is not longer than the total reproduction time Tt (NO in step S304) or when the normal reproduction mode is not selected in step S310, the battery 100 will be exhausted during reproduction of the selected data, and therefore the selected data will not be reproduced to the end. In this case, the process moves on to step S311, the reproduction control section 103 displays a message or icon on the display section 106 indicating that the selected data cannot be reproduced to the end and warns the user of it. At this time, the reproduction control section 103 may also display the total reproduction time Tt, reproducible time Ta and their difference on the display section 106.

In step S312, the UI section 104 prompts the user to select a normal reproduction mode or summary reproduction mode. When the user selects the normal reproduction mode, the process in step S305 is executed. On the other hand, if the user selects the summary reproduction mode, the process in step S313 is executed.

If the summary reproduction mode is selected, the UI section 104 prompts the user to select one of summary schemes in step S313. In step S313, for example, the summary scheme can be selected from the summary schemes 1 to 4 explained in the above-described first embodiment.

In step S314, the reproduction control section 103 generates summary data which is a summary of the selected data based on the summary scheme selected by the user. At this time, the reproduction control section 103 makes sure that the total reproduction time of the summary data is shorter than the current reproducible time Ta. If the time taken to generate the summary is long, the remaining power of the battery 100 may reduce drastically causing the reproducible time to be shortened. Thus, upon creating summary data the reproduction apparatus 10 according to the second embodiment re-predicts a reproducible time at predetermined intervals and compares it with the total reproduction time.

In step S315, the reproduction control section 103 starts to reproduce the summary data. Unlike the reproduction apparatus 10 according to the first embodiment, the reproduction apparatus 10 according to the second embodiment does not restrict operations such as fast rewind, fast forward, pause except a stop operation after the reproduction of the summary data is started. Therefore, if these operations are performed during reproduction, the remaining power of the battery may be too small to reproduce all summary data. Operations in and after step S316 will be carried out to handle such a case.

In step S316, the reproduction control section 103 decides whether the reproduction of the summary data is completed or not.

If the reproduction of the summary data is not completed (NO in step S316), the process moves on to step S317 and the reproduction control section 103 calculates a remaining reproduction time Trs of the remaining summary data.

In step S318, the reproduction control section 103 makes the detection section 101 detect the current remaining power of the battery 100 and makes the prediction section 102 predict the current reproducible time Ta. At this time, the detection section 101 detects the current remaining power of the battery 100 and notifies it to the prediction section 102. In turn, the prediction section 102 predicts the current reproducible time Ta using the current remaining power of the battery 100 and notifies it to the reproduction control section 103.

In step S319, the reproduction control section 103 decides whether the reproducible time Ta is longer than the remaining reproduction time Trs or not. This decision corresponds to a decision as to whether the summary data can be reproduced to the end or not. When the reproducible time Ta is longer than the remaining reproduction time Trs (YES in step S319), the process moves back to step S316 and the reproduction control section 103 continues to reproduce the summary data.

When the reproducible time Ta is not longer than the remaining reproduction time Trs (NO in step S319), the summary data cannot be reproduced to the end. In this case, the process moves on to step S320 and the reproduction control section 103 changes the content of the summary data. Then, after changing the content of the summary data, the reproduction control section 103 starts to reproduce the changed summary data. If video data is found in the summary data, the reproduction control section 103 processes it and supplies it to the display section 106 and if audio data is found in the summary data, the reproduction control section 103 processes it and supplies it to the speaker section 107.

As described above, the reproduction apparatus 10 according to the second embodiment can perform reproduction processing in consideration of the remaining power of the battery 100. Furthermore, when the remaining power of the battery 100 is too small to reproduce the digital data selected by the user to the end, the reproduction apparatus 10 according to the second embodiment can warn the user of it. Furthermore, the reproduction apparatus 10 according to the second embodiment need not restrict operations such as fast rewind, fast forward, pause even in a summary reproduction mode.

Third Embodiment

With reference to FIG. 4 and FIG. 5, a first embodiment of the present invention will be explained in detail below.

First, with reference to the block diagram in FIG. **4**, a configuration example of a reproduction apparatus **40** according to a first embodiment will be explained. The reproduction apparatus **40** shown in FIG. **4** is a portable device that is driven by a battery **400** and has the function of reproducing digital data stored in a storage medium **405**. The digital data that the reproduction apparatus **40** reproduces from the storage medium **405** may be video data, audio data, or video data with audio data.

As shown in FIG. **4**, the reproduction apparatus **40** includes the battery **400**, a detection section **401**, a prediction section **402**, a reproduction control section **403**, a UI section **404**, a storage medium **405**, a display section **406** and a speaker section **407**.

The detection section **401** has the function of detecting the remaining power of the battery **400**. The prediction section **402** has the function of predicting an reproducible time using the remaining power of the battery **400**. The reproduction control section **403** has the function of reproducing the digital data selected by the user from the storage medium **405**. The user interface section (UI section) **404** has the function of notifying the reproduction control section **403** of the user's instructions. The display section **406** displays video data in the digital data reproduced from the storage medium **405**. The speaker section **407** outputs the audio data in the digital data reproduced from the storage medium **405**.

Next, the processing procedure of the reproduction apparatus **40** according to the third embodiment will be explained with reference to the flow chart in FIG. **5**.

In step S**401**, the UI section **404** prompts the user to select digital data to be reproduced.

In step S**402**, the reproduction control section **403** makes the prediction section **402** to predict total power consumption Pt which is power consumption required to reproduce all the digital data selected by the user (hereinafter referred to as "selected data"). The prediction section **402** predicts the current total power consumption Pt and notifies it to the reproduction control section **403**.

In step S**403**, the reproduction control section **403** makes the detection section **401** detect the current remaining power Pb of the battery **400**. The detection section **401** detects the current remaining power Pb of the battery **400** and notifies it to the reproduction control section **403**.

In step S**404**, the reproduction control section **403** decides whether the current remaining power Pb of the battery **400** is greater than the total power consumption Pt or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not.

When the current remaining power Pb of the battery **400** is greater than the total power consumption Pt (YES in step S**404**), the selected data can be reproduced to the end. In this case, the process moves on to step S**405** and the reproduction control section **403** starts to reproduce the selected data without generating any summary of the selected data.

On the other hand, when the current remaining power Pb of the battery **400** is not greater than the total power consumption Pt (NO in step S**404**), the battery **400** will be exhausted during reproduction of the selected data and the selected data will not be reproduced to the end. In this case, the process moves on to step S**406**, the reproduction control section **403** displays a message or icon on the display section **406** indicating that the selected data cannot be reproduced to the end and warns the user of it. At this time, the reproduction control section **403** can also display the current remaining power Pb of the battery **400**, total power consumption Pt and the difference thereof on the display section **406**.

In step S**407**, the UI section **404** prompts the user to select a normal reproduction mode or summary reproduction mode. When the user selects the normal reproduction mode, the process in step S**405** is executed. On the other hand, if the user selects the summary reproduction mode, the process in step S**408** is executed.

In step S**408**, the UI section **404** prompts the user to select one of the summary schemes. In step S**408**, for example, the summary scheme can be selected from the summary schemes 1 to 4 explained in the above-described first embodiment.

In step S**409**, the reproduction control section **403** generates summary data which is a summary of the selected data based on the summary scheme selected by the user. At this time, the reproduction control section **403** makes sure that the total power consumption of the summary data is smaller than the current remaining power Pb of the battery **400**. If the time taken to generate the summary is long, the remaining power of the battery **400** may reduce drastically. Thus, upon creating summary data the reproduction apparatus **40** according to this third embodiment re-detects the remaining power of the battery **400** at predetermined intervals and compares it with the total power consumption of the summary data.

After the reproduction of the summary data is started, operations such as fast rewind, fast forward and pause may reduce the remaining power of the battery **400** drastically, causing the battery **400** to be exhausted during the reproduction of the summary data. Therefore, the UI section **404** starts the reproduction of the summary and then disables operations other than stop (fast rewind, fast forward, pause, etc.) in step S**410**. This function prevents the reproduction of the summary data from being interrupted midway.

In step S**411**, the reproduction control section **403** starts to reproduce summary data. If video data is found in the summary data, the reproduction control section **403** processes it and supplies it to the display section **406** and if audio data is found in the summary data, the reproduction control section **403** processes it and supplies it to the speaker section **407**.

As described above, the reproduction apparatus **40** according to the third embodiment can perform reproduction processing in consideration of the remaining power of the battery **400**. Furthermore, when the remaining power of the battery **400** is not enough to reproduce the digital data selected by the user to the end, the reproduction apparatus **40** according to the third embodiment can warn the user of it.

Fourth Embodiment

With reference to FIG. **4** and FIG. **6**, the fourth embodiment of the present invention will be explained in detail below. The operation carried out by the prediction section **402** is the same as the operation explained in the above-described third embodiment.

With reference to the flow chart in FIG. **6**, the processing procedure of the reproduction apparatus **40** according to the fourth embodiment will be explained.

In step S**501**, the UI section **404** prompts the user to select digital data to be reproduced.

In step S**502**, the reproduction control section **403** makes the prediction section **402** predict total power consumption Pt which is power consumption necessary to reproduce all digital data selected by the user (hereinafter referred to as "selected data"). The prediction section **402** predicts the total power consumption Pt of the selected data and notifies it to the reproduction control section **403**.

In step S**503**, the reproduction control section **403** makes the detection section **401** detect the current remaining power of the battery **400**. The detection section **401** detects the current remaining power Pb of the battery **400** and notifies it to the reproduction control section **403**.

In step S**504**, the reproduction control section **403** decides whether the current remaining power Pb of the battery **400** is greater than the total power consumption Pt or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not.

If the current remaining power Pb of the battery **400** is greater than the total power consumption Pt (YES in step S**504**), the selected data can be reproduced to the end. In this case, the process moves on to step S**505** and the reproduction control section **403** starts to reproduce the selected data without generating any summary of the selected data.

In step S**506**, the reproduction control section **403** decides whether the reproduction of the selected data is completed or not.

If the reproduction of the selected data is not completed (NO in step S**506**), in step S**507**, the reproduction control section **403** makes the prediction section **402** predict power consumption Pr of the unreproduced portion of the selected data. The prediction section **402** predicts the power consumption Pr of the unreproduced portion and notifies it to the reproduction control section **403**.

In step S**508**, the reproduction control section **403** makes the detection section **401** re-detect the current remaining power Pb of the battery **400**. The detection section **401** detects the current remaining power Pb of the battery **400** and notifies it to the reproduction control section **403**.

In step S**509**, the reproduction control section **403** decides whether the current remaining power Pb of the battery **400** is greater than the power consumption Pr or not. This decision corresponds to a decision as to whether the selected data can be reproduced to the end or not. If the current remaining power Pb of the battery **400** is greater than the power consumption Pr (YES in step S**509**), the process moves back to step S**506** and the reproduction control section **403** continues to reproduce the selected data.

If the current remaining power Pb of the battery **400** is not greater than the power consumption Pr (NO in step S**509**), the selected data cannot be reproduced to the end. In this case, the process moves on to step S**510** and the reproduction control section **403** decides whether the normal reproduction mode is selected or not. If the normal reproduction mode is selected, the reproduction control section **403** continues to reproduce the selected data without creating any summary.

Furthermore, as a result of the decision in step S**504**, if the current remaining power Pb of the battery **400** is not greater than the power consumption Pt (NO in step S**504**) or if the normal reproduction mode is not selected in step S**510**, the battery **400** will be exhausted during reproduction of the selected data, and therefore the selected data will not be reproduced to the end. In this case, the process moves on to step S**511** and the reproduction control section **403** displays a message or icon on the display section **406** indicating that the selected data cannot be reproduced to the end and warns the user of it. At this time, the reproduction control section **403** may also display the current remaining power Pb of the battery **400**, power consumption Pt or Pr of the unreproduced portion and the difference thereof on the display section **406**.

In step S**512**, the UI section **404** prompts the user to select a normal reproduction mode or summary reproduction mode. If the user selects the normal reproduction mode, the process in step S**505** is executed. On the other hand, if the user selects the summary reproduction mode, the process in step S**513** is executed.

If the summary reproduction mode is selected, the UI section **404** prompts the user to select one of summary schemes in step S**513**. In step S**513**, for example, the summary scheme can be selected from the summary systems 1 to 4 explained in the above-described first embodiment.

In step S**514**, the reproduction control section **403** generates summary data which is a summary of the selected data based on the summary scheme selected by the user. At this time, the reproduction control section **403** makes sure that the total power consumption of the summary data is smaller than the current remaining power Pb of the battery **400**. If the time taken to generate the summary data is long, the remaining power of the battery **400** may reduce drastically. Thus, upon generating the summary data, the reproduction apparatus **40** according to the fourth embodiment re-detects the remaining power of the battery **400** at predetermined intervals and compares it with the total power consumption of the summary data.

In step S**515**, the reproduction control section **403** starts to reproduce the summary data. Unlike the reproduction apparatus **40** of the third embodiment, the reproduction apparatus **40** of the fourth embodiment does not restrict operations other than stop (fast rewind, fast forward, pause, etc.) after reproduction of the summary data is started. Thus, if these operations are carried out during reproduction, the remaining power of the battery may be not enough to reproduce all summary data. Operations in and after step S**516** will be carried out to handle such a case.

In step S**516**, the reproduction control section **403** decides whether the reproduction of the summary data is completed or not.

If the reproduction of the summary data is not completed (NO in step S**516**), the process moves on to step S**517** and the reproduction control section **403** makes the prediction section **402** predict power consumption Prs of the unreproduced portion of the summary data. The prediction section **402** predicts the power consumption Prs of the unreproduced portion and notifies it to the reproduction control section **403**.

In step S**518**, the reproduction control section **403** makes the detection section **401** detect the current remaining power Pb of the battery **400**. The detection section **401** detects the current remaining power Pb of the battery **400** and notifies it to the reproduction control section **403**.

In step S**519**, the reproduction control section **403** decides whether the current remaining power Pb of the battery **400** is greater than the power consumption Prs or not. This decision corresponds to a decision as to whether the summary data can be reproduced to the end or not. If the current remaining power Pb of the battery **400** is greater than the power consumption Prs (YES in step S**519**), the process moves back to step S**516** and the reproduction control section **403** continues to reproduce the summary data.

If the current remaining power Pb of the battery **400** is not greater than the power consumption Prs (NO in step S**519**), the summary data cannot be reproduced to the end. In this case, the process moves on to step S**520** and the reproduction control section **403** changes the content of the summary data. Then, after changing the content of the summary data, the reproduction control section **403** starts to reproduce the changed summary data. If video data is found in the summary data, the reproduction control section **403** processes it and supplies it to the display section **406** and if audio data is found in the summary data, the reproduction control section **403** processes it and supplies it to the speaker section **407**.

As described above, the reproduction apparatus **40** according to the fourth embodiment can perform reproduction processing in consideration of the remaining power of the battery **400**. Furthermore, when the remaining power of the battery **400** is not enough to reproduce the digital data selected by the user to the end, the reproduction apparatus **40** according to the fourth embodiment can warn the user of it. In accordance with the reproduction apparatus **40** according to the fourth embodiment, there is no need to restrict operations such as fast rewind, fast forward, pause even in the summary reproduction mode.

Other Embodiment

Further, the object of the present invention can also be achieved by providing a storage medium storing program

codes for performing the aforesaid processes to a computer system or apparatus (e.g., a personal computer), reading the program codes, by a CPU or MPU of the computer system or apparatus, from the storage medium, then executing the program.

In this case, the program codes read from the storage medium realize the functions according to the embodiments, and the storage medium storing the program codes constitutes the invention.

Further, the storage medium, such as a floppy disk, a hard disk, an optical disk, a magneto-optical disk, CD-ROM, CD-R, a magnetic tape, a non-volatile type memory card, and ROM, and computer network, such as LAN (local area network) and WAN (wide area network), can be used for providing the program codes.

Furthermore, besides aforesaid functions according to the above embodiments are realized by executing the program codes which are read by a computer, the present invention includes a case where an OS (operating system) or the like working on the computer performs a part or entire processes in accordance with designations of the program codes and realizes functions according to the above embodiments.

Furthermore, the present invention also includes a case where, after the program codes read from the storage medium are written in a function expansion card which is inserted into the computer or in a memory provided in a function expansion unit which is connected to the computer, CPU or the like contained in the function expansion card or unit performs a part or entire process in accordance with designations of the program codes and realizes functions of the above embodiments.

In a case where the present invention is applied to the aforesaid storage medium, the storage medium stores program codes corresponding to the flowchart shown in any one of FIGS. **2**, **3**, **5** and **6** described in the embodiments.

The present invention is not limited to the above embodiments and various changes and modifications can be made within the spirit and scope of the present invention. Therefore to apprise the public of the scope of the present invention, the following claims are made.

What is claimed is:

1. A reproduction apparatus comprising:

a reproduction unit that reproduces digital data selected by a user from a storage medium;

a detection unit that detects a reproducible time based on remaining power of a battery; and

a determination unit that determines whether the selected digital data can be reproduced to the end or not based on the reproducible time detected by the detection unit, before the reproduction unit starts reproducing the selected data,

wherein if it is determined by the determination unit that the selected digital data can be reproduced to the end, the reproduction apparatus causes the reproduction unit to reproduce the selected digital data,

if it is determined by the determination unit that the selected digital data cannot be reproduced to the end, the reproduction apparatus warns that the selected digital data cannot be reproduced to the end, and

if it is determined by the determination unit that the selected digital data cannot be reproduced to the end, the reproduction apparatus causes the user to select whether or not to reproduce the selected digital data.

2. The reproduction apparatus according to claim **1**, wherein the digital data includes at least one of video data and audio data.

3. A non-transitory storage medium that stores a program for causing a computer to act as the reproduction apparatus according to claim **1**.

4. A reproduction apparatus comprising:

a reproduction unit that reproduces digital data selected by a user from a storage medium;

a detection unit that detects a reproducible time based on remaining power of a battery; and

a determination unit that determines whether the selected digital data can be reproduced to the end or not based on the reproducible time detected by the detection unit, before the reproduction unit starts reproducing the selected data,

wherein if it is determined by the determination unit that the selected digital data can be reproduced to the end, the reproduction apparatus causes the reproduction unit to reproduce the selected digital data,

if it is determined by the determination unit that the selected digital data cannot be reproduced to the end, the reproduction apparatus warns that the selected digital data cannot be reproduced to the end,

if it is determined by the determination unit that the selected digital data cannot be reproduced to the end, the reproduction apparatus causes the user to select one of first and second reproduction modes,

if the first reproduction mode is selected by the user, the reproduction apparatus causes the reproduction unit to reproduce the selected digital data, and

if the second reproduction mode is selected by the user, the reproduction apparatus causes the reproduction unit to reproduce summary data including a summary of the selected digital data.

5. The reproduction apparatus according to claim **4**, wherein if it is determined based on the reproducible time detected by the detection unit that the summary data cannot be reproduced to the end, the reproduction apparatus re-creates new summary data.

6. The reproduction apparatus according to claim **4**, wherein if the second reproduction mode is selected by the user, the reproduction apparatus causes the user to select one of summary methods and creates the summary data based on the summary method selected by the user.

7. The reproduction apparatus according to claim **4**, wherein the digital data includes at least one of video data and audio data.

8. A non-transitory storage medium that stores a program for causing a computer to act as the reproduction apparatus according to claim **4**.

9. A method for controlling a reproduction apparatus including a reproduction unit that reproduces digital data selected by a user from a storage medium, the method comprising:

a detecting step of detecting a reproducible time based on remaining power of a battery;

a determining step of determining whether the selected digital data can be reproduced to the end or not based on the reproducible time detected in the detecting step, before the reproduction unit starts reproducing the selected digital data;

a step of causing the reproduction unit to reproduce the selected digital data if it is determined in the determining step that the selected digital data can be reproduced to the end;

a step of warning that the selected digital data cannot be reproduced to the end if it is determined in the determining step that the selected digital data cannot be reproduced to the end; and

a step of causing the user to select whether to reproduce the digital data if it is determined in the determining step that the selected digital data cannot be reproduced to the end.

10. The method according to claim **9**, wherein the digital data includes at least one of video data and audio data.

11. A method for controlling a reproduction apparatus including a reproduction unit that reproduces digital data selected by a user from a storage medium, the method comprising:

a detecting step of detecting a reproducible time based on remaining power of a battery;

a determining step of determining whether the selected digital data can be reproduced to the end or not based on the reproducible time detected in the detecting step, before the reproduction unit starts reproducing the selected digital data;

a step of causing the reproduction unit to reproduce the selected digital data if it is determined in the determining step that the selected digital data can be reproduced to the end;

a step of warning that the selected digital data cannot be reproduced to the end if it is determined in the determining step that the selected digital data cannot be reproduced to the end;

a step of causing the user to select one of first and second reproduction modes if it is determined in the determining step that the selected digital data cannot be reproduced to the end;

a step of causing the reproduction unit to reproduce the selected digital data if the user selects the first reproduction mode; and

a step of causing the reproduction unit to reproduce summary data including a summary of the selected digital data if the user selects the second reproduction mode.

12. The method according to claim 11, further comprising

a step of re-creating new summary data if it is determined based on the reproducible time detected by the detecting step that the summary data cannot be reproduced to the end.

13. The method according to claim 11, further comprising the steps of:

causing the user to select one of summary methods if the second reproduction mode is selected by the user; and

creating the summary data based on the summary method selected by the user.

14. The method according to claim 11, wherein the digital data includes at least one of video data and audio data.

15. A non-transitory storage medium that stores a program for causing a computer to execute a method for controlling the computer, the method comprising:

a step of causing a reproduction unit to reproduce digital data selected by a user from a storage medium;

a detecting step of detecting a reproducible time based on remaining power of a battery;

a determining step of determining whether the selected digital data can be reproduced to the end or not based on the reproducible time detected in the detecting step, before the reproduction unit starts reproducing the selected digital data;

a step of causing the reproduction unit to reproduce the selected digital data if it is determined in the determining step that the selected digital data can be reproduced to the end;

a step of warning that the selected digital data cannot be reproduced to the end if it is determined in the determining step that the selected digital data cannot be reproduced to the end; and

a step of causing the user to select whether to reproduce the digital data if it is determined in the determining step that the selected digital data cannot be reproduced to the end.

16. The non-transitory storage medium according to claim 15, wherein the digital data includes at least one of video data and audio data.

17. A non-transitory storage medium that stores a program for causing a computer to execute a method for controlling the computer, the method comprising:

a step of causing a reproduction unit to reproduce digital data selected by a user from a storage medium;

a detecting step of detecting a reproducible time based on remaining power of a battery;

a determining step of determining whether the selected digital data can be reproduced to the end or not based on the reproducible time detected in the detecting step, before the reproduction unit starts reproducing the selected digital data;

a step of causing the reproduction unit to reproduce the selected digital data if it is determined in the determining step that the selected digital data can be reproduced to the end;

a step of warning that the selected digital data cannot be reproduced to the end if it is determined in the determining step that the selected digital data cannot be reproduced to the end;

a step of causing the user to select one of first and second reproduction modes if it is determined in the determining step that the selected digital data cannot be reproduced to the end;

a step of causing the reproduction unit to reproduce the selected digital data if the user selects the first reproduction mode; and

a step of causing the reproduction unit to reproduce summary data including a summary of the selected digital data if the user selects the second reproduction mode.

18. The non-transitory storage medium according to claim 17, the method further comprising a step of re-creating new summary data if it is determined based on the reproducible time detected by the detecting step that the summary data cannot be reproduced to the end.

19. The non-transitory storage medium according to claim 17, the method further comprising the steps of:

causing the user to select one of summary methods if the second reproduction mode is selected by the user; and

creating the summary data based on the summary method selected by the user.

20. The non-transitory storage medium according to claim 17, wherein the digital data includes at least one of video data and audio data.

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